Article

Throw me a lifeline: Articulating mobile social network dispersion and the social construction of risk in rescue communication

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Abstract

This research develops a model of mobile social network dispersion in rescue communication, and illustrates how people use a combination of mobile and social media, along with real-time communication, in their decision-making process. Guided by established research on smartphones, social media, and affordances, we used a qualitative approach and conducted field interviews that included photo-elicitation interview (PEI) techniques to examine participants' private social media data. Our analysis of these rescue decisions reveals why so few people used the official 9-1-1 system. We show how rescue communication often occurs through a socially constructed assessment of risk that involves persuasion by trusted others in their network, regardless of professional qualifications. Furthermore, trusted others can function as proxies and can draw upon mobile social network affordances, helping to compensate for material limitations. The affordances people drew from can be organized into two sets: foundational and amplification. Hierarchical relationships exist among these sets of affordances, and materiality plays a pivotal role in rescue communication. Ultimately, our analysis uncovers the multimodality around people's decisions to ask for help.

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Hurricane Harvey was the first North American disaster where social media "calls" for help appeared to have supplanted the overloaded 9-1-1 call systems (Rhodan, 2017). While emergency response efforts are often reliant on people calling 9-1-1 to report their needs for help, a juxtaposition occurred during Hurricane Harvey, where state and federal agencies like the U.S. Coast Guard were overloaded, and thus, they specifically requested that volunteers jump in and help them respond to these calls for help. This form of help-seeking behavior on public social media is not new (Murthy & Longwell, 2013), but in this disaster, social media provided a visible, often image-based way for the public to request and receive help. Because both volunteers and disaster victims used mobile devices—most often via apps on smartphones—to connect and communicate during rescues, we adopt the term mobile social networks (Humphreys, 2012) to explain how smartphones and social media worked together in the disaster rescue process.

This study explores links between people, materiality, and the technological affordances used by rescuees during Hurricane Harvey. While ultimately people need to be physically involved in executing rescues, the communication tools—objects, machines, and artifacts—are items often underanalyzed (Pinch, 2008), and they can play a key material role in the rescue process. Mobile social networks are one relevant set of material artifacts, and knowing how people perceive the usefulness of these objects can link materiality and affordances (Gibson, 1986). This is especially relevant in contexts of disaster. Humphreys, Karnowski, and von Pape (2018) stress that "situational context shapes both the availability of constituent media as well as the perception of various features of each constituent medium" (p. 2802). Furthermore, affordances are not always used in isolation, an important factor articulated in Humphreys et al.'s (2018) integrated model; affordances can be shared and drawn upon collectively (Leonardi, 2013; Stephens, 2018).

Research suggests that during Hurricane Harvey and the flooding that resulted from this disaster, mobile social networks played a clear role in the communication practices in this context (W. R. Smith, Stephens, Robertson, Li, & Murthy, 2018). Therefore, this study extends the technological affordances literature into a disaster context by probing individuals to articulate why they posted texts and images, what they shared, and how this is linked to being rescued during Hurricane Harvey. In this way, our research seeks to understand the nuance of rescuees' motivations and experiences, knowledge that we use to develop a theoretical model articulating how sets of affordances can be activated using mobile social networks during disasters.

Technological affordances

Gibson (1986) defined affordances as the perception of the usefulness of an object that is derivative of one's environment. He conceptualized an affordance as relational, triggered by "the particular ways in which an actor, or set of actors, perceives and uses [an] object" (p. 145). While this definition is not rooted in technology, sociologists and communication

scholars have followed suit, arguing that technology has the potential to shape social action and communication practices. Specifically, affordances exist not as a "latent capability innate to the technology, but as a potentiality" activated and shaped by certain groups, especially during urgent situations and environments (Majchrzak, Faraj, Kane, & Azad, 2013, p. 39). As a theoretical framework, affordances of technology, such as the persistence and visibility of content, can help describe how technology has the potential to alter communicative practices depending upon one's environment, therefore situationally defining the object's utility (Vitak & Ellison, 2012). Since technology tends to be used instrumentally and habitually (e.g., Bayer, Campbell, & Ling, 2016), by understanding the relational and communicative potential of mobile social networks, we can better comprehend constantly shifting contexts such as disasters.

Affordances provide a framework to understand relationships while preserving relational ontology even when the contexts of technology use are dynamic, the attributes and abilities of users are diverse, and the materiality of technologies is unstable. People often confuse affordances and features, so Evans, Pearce, Vitak, and Treem (2017) developed three criteria to determine whether a particular technological usage meets the minimum threshold criteria to qualify as an affordance. They claim that it cannot be a feature of a technology, an outcome of its use, and it must have variability in how it is used. Social network sites (boyd, 2010; Pearce, Barta, & Fesenmaier, 2015), social media (Majchrzak et al., 2013; Treem & Leonardi, 2012), and mobile devices (Schrock, 2015; Stephens, 2018) have all been examined through an affordance-based framework.

Mobile devices

Mobile devices, which include smartphones, tablets, and wearables can integrate multimedia (typically through a microphone and camera), provide cellular or wireless network connection, and include mobile applications. Smartphones are not a singular medium, and whether we refer to them as combinatorial ICT use (e.g., Stephens, 2018; Stephens, Barrett, & Mahometa, 2013), multiple media use (e.g., Stephens & Malone, 2009), polymedia (e.g., Madianou, 2014), or metamedia (e.g., Jensen, 2016), this becomes an important consideration when discussing materiality and *sets of affordances* associated with mobile devices. Combinatorial devices like smartphones are used in myriad ways, and users often treat them as "integrated environments of affordances" (Madianou, 2014, p. 667). Furthermore, scholars are now arguing that individuals are using mobile devices to access social media so frequently that this practice is now the new norm (Humphreys & Evans, 2017). Thus, the term *mobile social networks* reflects the combinatorial nature of humans accessing social media through mobile devices.

Affordances of mobile social networks. Initial attempts at identifying affordances have separated mobile and social media, and these scholars have also examined them in specific contexts. For example, Schrock (2015) devised a typology of four main mobile communicative affordances that he synthesized from previous literature: portability, availability, locatability, and multimediality. Treem and Leonardi (2012) identified four affordances often found associated with organizational social media use: visibility, editability, persistence, and association. Stephens (2018) suggested that reachability is a core affordance

associated with smartphones and that this affordance involves other people with both positive and negative consequences. While this early work is helpful, in our current study, we use this past literature to sensitize ourselves, but not to limit what we might find in a disaster context.

Calls for rescue: Context of research

Consistently, scholars have stressed that affordances should be understood by also considering the context in which people can and choose to invoke them (e.g., Gibson, 1986; Humphreys et al., 2018). In the US, the system operated by the government that is designed to provide emergency help is the 9-1-1 phone/text system. Additionally, people around the globe are using smartphones and social media for real-time information about emergencies (Hoxie, 2016; Jacquez, 2016; Murthy, 2018; W. R. Smith et al., 2018; Stephens et al., 2013). Moreover, during Hurricane Harvey, instead of calling 9-1-1, citizens reacted to the storm by posting their requests for help on social media (Rhodan, 2017), yet we understand almost nothing about the rescuees' motivations to issue a social-media "call for help" instead of using the traditional, long-established 9-1-1 system.

The use of social media has been documented and examined in natural disasters (Palen & Hughes, 2018), and in crises (Austin, Fisher Liu, & Jin, 2012). Veil, Buehner, and Palenchar's (2011) review of the literature found that most social-media-related studies in communication focus on warnings, response activities, and the quick dissemination of information during a disaster; studies of social media use in times of crisis are skewed toward examining the responding organization, not the average citizen. Additionally, Houston et al.'s (2014) comprehensive review of disaster social media literature found similar results in that social media have generally been used to "provide and receive disaster warnings" (p. 2). While many scholars have studied communication technology used in emergencies, crises, and disasters (see Murthy & Gross, 2017; Stephens et al., 2013; Stephens & Malone, 2009), individuals' motivations to draw upon technological affordances are rarely examined. With the growing knowledge base surrounding research on communication affordances, extending this work into disasters could be especially helpful.

It is not surprising that mobile social networks have emerged as platforms used to request assistance, because the American public uses social media on their mobile devices at increasing rates (A. Smith & Anderson, 2018). And now citizens assume emergency personnel also communicate through social media, even when they do not. An American Red Cross study found that people believe that emergency personnel monitor social media and that their calls for help will be answered if they simply post a message ("New Study Shows," 2012). This is somewhat understandable given how it has become the norm to request assistance from companies and organizations via apps or websites rather than picking up the phone, but it is highly problematic and violates expectations in disasters (Jacquez, 2016).

Research question

To date, most of the research on crisis, emergency, and disaster communication that has examined the use of social media has focused on *publicly available data* found on platforms like Twitter, Facebook, Instagram, or Reddit (e.g., Murthy, 2018; Murthy &

Longwell, 2013; Veil et al., 2011). Our study, however, is designed to uncover the motivations and experiences of people posting on social media when they need help. This form of rescue communication requires us to access *private* communication given that public fora are not as frequently used to elicit help. This approach therefore expands our collective understanding of mobile and social media use during a crisis. Therefore, the following research question is posed:

RQ: How did rescuees use official 9-1-1 systems and their personal mobile social networks to get rescued?

Method

Sample

We negotiated access to a social work organization in the greater Houston, Texas, U.S. region, which allowed the researchers permission to interview individuals who received financial assistance immediately following Hurricane Harvey. We screened participants based upon the following criteria: (a) 18 years of age or older, (b) had a mobile device, (c) posted on social media through their mobile device during the time of the hurricane (whether that led to their rescue or not), and (d) were rescued by an official rescue/relief organization (e.g., U.S. Coast Guard, local law enforcement) or volunteer rescue groups (e.g., the Cajun Navy, self-organized individuals). Our team took field notes as we spent 5 days in this organization and 14 additional days in the community surrounding this organization. The researchers set up a table at the research site and conducted interviews in a private room while participants were waiting to meet with a social worker, or directly after their meeting. Only participants who met all four criteria were invited to be interviewed. These interviews took place between two to five months after Hurricane Harvey (November 2017 to March 2018).

We had 17 individuals who met the criteria for participation, and they were each assigned a pseudonym (see Table 1). The average age of the participants was 45.47, with an age range between 24 and 59 years of age ($SD = 8.73$). The sample was representative of the surrounding community and contained three people who identified as African American, five as Asian, and nine as Caucasian. Seven were male and 10 were female; one person made less than $25,000/year and 12 made over $75,000/year prior to the disaster. While this sample size is relatively small, the number of interviews to be completed was not preset. In qualitative research, access to vulnerable respondents is remarkably difficult, and thus if rich data are captured, smaller samples can be acceptable, especially when the participants reflect upon a particularly stressful incident or event (Moore & Miller, 1999). Moreover, the interviews conducted reflect "thick descriptive" methods (Geertz, 2008) and a highly nuanced understanding of the sample's disaster experiences, emphasizing detail over volume.

Data collection

The data were collected using semistructured interviews with questions focused on understanding how people used communication technologies to be rescued. We began

Table 1. Study participants.

Pseudonym	Age	Channel(s) used for communicating rescue	Extenuating circumstances for rescue
Ann	55	Facebook	Disabled and caretaker of 80-year-old father
Brooklyn	53	Facebook, Facebook Live, group text message	Evacuated early
Caspa	41	Facebook, group text message, Nextdoor, Zello	Rescued and then rescued others
Emily	39	Facebook, Google Maps, group text message, Nextdoor, Zello	Never imagined needing to evacuate
Faith and Arnold (couple)	44 and 47	Facebook, group text message, Zello	Previously flooded
Geri	36	Facebook, Instagram, Nextdoor	Pregnant during rescue
Harij and Anika (couple)	46 and 44	Facebook, Nextdoor, WhatsApp	Evacuated with 8-year-old daughter. Permanent residents
Jon	24	Facebook, Instagram, Snapchat	Lived in apartment building
Jake	38	Facebook, WeChat	Experienced Hurricane Katrina
Karen	50	Facebook, group text message	Experienced Hurricane Katrina. Called Office of Emergency Management, told no need to evacuate
Mick	50	Facebook	Dog owner
Sam	42	Facebook, WeChat	Employer rescued him
Tammy and Stephen (couple)	58 and 59	Facebook, Nextdoor	Friends all over the world shared her posts
Tracey	47	Elevation application, Facebook, WeChat	Single mother

Note. All rescuees mentioned using face-to-face communication and phone calls to trusted others, in addition to using varied forms of social media.

with the question, "Tell us your rescue story," then asked about the communication technologies they used during the rescue process, and at the appropriate time, we asked questions to help us better understand how they drew upon affordances of technology.

In addition, we used photo elicitation interview (PEI) techniques (Clark-Ibáñez, 2004; Harper, 2002), a data collection strategy that invites respondents to share photos as part of the research process. Integrating smartphones in qualitative interviews has become a trend in mobile communication research (Kaufmann, 2018). For example, while telling their story, we asked respondents to select images from their phones and tell us the detailed stories behind them, a modality of the PEI that also helps as a memory aid. This is especially relevant when studying mobile social networks because images are an important part of disaster experience (Murthy, Gross, & McGarry, 2016), and by referencing their

actual images, the respondents visually curated their own disaster experience while sharing those visual data with our research project. The protocol used in this study was unique because of our desire to understand the motivations of rescue communication, so we asked people to share *private* data (with IRB approval from the University of Texas at Austin), not simply social media data posted to public sites. Furthermore, we gained deeper insights into the context by allowing participants to share their stories and images related to the impact of Hurricane Harvey and specifically their rescue. We collected images by either taking a photo of them using our project phone, or having participants screenshot the photos and send them to us for secure storage. These interviews ranged from 20 to 65 minutes, with an average of 39.94 ($SD = 13.75$) minutes.

Data analysis

The interviews and field notes were transcribed verbatim and imported into NVivo 9.0. Each collected photo was labeled and stored in a secured folder dedicated to that participant's data. We used a constant comparative method (Glaser & Strauss, 1967) to structure our analysis. Two researchers independently reviewed the data from each participant—transcript, field notes, and images—and created a set of open codes addressing the research questions. The researchers then met to discuss the emerging core categories and how they might best be organized to both answer our research questions and provide new explanations that could be a unique contribution of the research. We used axial coding to relate the open codes and, after categorizing our codes (Corbin & Strauss, 1990), the researchers together selected transcripts and photos that illustrated each core category.

Results

The research question dug into the perceptions of the rescuees and how they themselves used official 9-1-1 sources and their mobile social networks to get rescued. This question invited us to explore materiality, along with the social, illustrated by cases in which people called 9-1-1, friends and family, and used social and mobile media. As we analyzed our data, we found that material considerations and affordances worked together in many situations, thus we present the findings by first discussing the use of 9-1-1, which was limited, followed by an extensive exploration of the use of mobile social networks.

Use of the official rescue channel 9-1-1

Table 2 reveals that only one person in our study actually tried to call 9-1-1, and he eventually gave up because his call did not go through. Another person heard from his neighbor that people who reached 9-1-1 were told that two-story homes were not a priority, so he assumed they would not care about his situation. Another couple had been monitoring Facebook and saw the repeated posts that 9-1-1 calls were not going through, while one person saw similar posts on Nextdoor. But almost half of the other people never even considered calling 9-1-1; they either (a) felt others needed it more, or (b) took advantage of evacuation opportunities.

Table 2. 9-1-1 Information.

Pseudonym	Called 9-1-1 in attempt to be rescued	Reason why did not call 9-1-1
Ann	No	Did not leave until police ordered them.
Brooklyn	No	Evacuated and left early before it felt serious.
Caspa	No	Rescued by his running group friends.
Emily	No	Realized too late and left on a boat.
Faith and Arnold (couple)	No	Was told through Facebook that 9-1-1 calls were not going through.
Geri	No	Did not think circumstances were dire, until they were.
Harij and Anika (couple)	No	Friends rescued them. Neighbor called 9-1-1 and was told two-story homes were a low priority for rescue.
Jon	Yes	Call did not go through.
Jake	No	National Guard knocked on their door and they left.
Karen	No	Heard 9-1-1 was down, and in hurricane culture, you do not call 9-1-1, you get out.
Mick	No	Did not realize how serious it was.
Sam	No	Resisted evacuating (boss told him to call 9-1-1) until water rose quickly and boats from his church arrived.
Tammy and Stephen (couple)	No	Did not think circumstances were dire, until they were.
Tracey	No	Saw boat rescues before she had a chance to call.

Others need it more. Geri, a woman who was 3 months pregnant and had a 1-year-old child with her, never called 9-1-1. She explained, "9-1-1 is a great idea for emergencies. And when you have an emergency state where everybody is in emergency, maybe the people with the most—the direst situations should have those lines open for them."

Even though she was pregnant, one of the officials rescuing her said, "Are you sure you're pregnant? I've heard a lot about pregnant people at this time." She explained that "when you don't look like you have special needs and you're given some special treatment, it can be socially embarrassing."

Evacuation opportunities. Two rescuees, Tracey and Mick, explained a different reason why they did not call 9-1-1: they did not take the situation seriously until they had to get out. Mick, a middle-aged woman explained it this way:

> It was embarrassing needing help. I mean, we're relaxing with a glass of wine after I thought I had taken care of everything, right? So this is kind of funny. It's even funnier now because [I didn't know what was about to happen]. I thought, I have the doors blocked, the front and the back door. I have my little Solo cups under my good furniture, and I mean I was working fast because it was coming up the sidewalk. And then I was resting, and then like, "Okay. Whatever

happens, happens." And again thinking maybe 2"–3", not above the Solo cups . . . I think I called a few neighbors, and I couldn't get in touch with them. Then we saw the water coming. At that moment, we felt like we shouldn't stay. And there was a boat. We told them that we wanted to leave. And so they pulled up to the driveway, close to the garage.

Use of specific social and mobile media

Table 1 provides a concrete overview of the special forms of mobile social networks that each participant used. All rescuees in our study used a smartphone, Facebook, face-to-face (FtF) communication, and made phone calls to trusted others. Three rescuees specifically mentioned using group text messages, one used Snapchat, several used Nextdoor, WeChat, and WhatsApp. They also used more specialized apps like Zello, the walkie-talkie app, Google Maps, and geographic elevation apps. Sometimes, their choices were dictated by what was available. For example, Karen, a woman who moved to the Greater Houston area after being devastated by Hurricane Katrina said,

> We didn't have TV. We didn't have Internet, so we really didn't know what was going on, but we were able to text our friends, and though they didn't know what was going on, because they're in Louisiana, we were able to communicate, "Come and get us."

All rescuees had at least cellular service, and that is what they used to send and receive messages, often through social media.

Materiality and smartphones

All participants stressed the importance of being able to physically move from place to place and have their mobile phones with them. For some participants, a mobile phone was their only way to communicate with others during the hurricane because either they did not own a landline phone, could not reach it, or it was inoperable. In many affected communities, landline phone services, power, and even wireless services were affected by the weather. Mick, who after her rescue was dropped off at a gas station located on higher ground, describes her mobile device like this, "So [our Internet] was kind of going in and out. And I was a little scared because really cell phone was the only thing that I could take with me and our way that we could contact people."

Mick explains how a cellular phone is portable, but also how that feature of this technology served as her go-to communication device, not only to calm her fears, but it was simultaneously her gateway to contacting others. This claim is consistent with media reports and statistics demonstrating the number of individuals who lost power in Houston during Harvey (approximately 280,000 homes were without power), and that meant people could only use their mobile devices, with ample battery life, to reach others (DiChristopher, 2017).

Failures of smartphones. In some instances, the portability feature of smartphones proved irrelevant because being able to physically move from place to place with an inoperable mobile device did not help hurricane and flooding victims get rescued. Jon, a 24-year-old

marketing manager whose apartment building experienced the rapid rise of flood waters, said he was grateful to be able to carry his phone with him as the flooding from the hurricane began to rise, but it ultimately proved insufficient.

> It was water resistant, and then it wasn't. I was in the water; it was up to my chest. So I'm thinking, "Oh, my iPhone 7, it's water resistant." And it wasn't *that* water resistant. [It was] splash resistant, but not submergible.

Jon's iPhone 7 was ultimately destroyed, but not before his Snapchat videos were automatically backed up to the cloud and, therefore, they were rescued too. Figure 1 illustrates one image of him wading through storm-contaminated water that he shared with his network before his phone was damaged.

Another reason Jon's phone was not fully usable during the evacuation was due to battery life, another challenge for the portability feature of his mobile phone.

> I was sharing stuff and moving around like, "Oh it's just nothing crazy." And once it started getting really surreal, that's when I had like shut off everything, because I was like, "I need to conserve my power at this point," It's like a fight or flight, you know, it's a life or death situation.

For Jon, the portability of his mobile device was essential, but portability, in turn, was also what made it inoperable. His experience did, however, demonstrate how he drew upon affordances of mobile social networks since he could recall and retrieve Snapchat messages that were backed up to his account before his phone was destroyed. Let us examine those next.

Mobile social network affordances

Our respondents' backgrounds and situations varied considerably, and that meant that they perceived the need to evacuate at different times. See Tables 1 and 2 for these variances. However, despite these differences, our analysis revealed how these rescuees drew upon (a) foundational and (b) amplification sets of affordances during their rescue experiences. The first major theme is what our team called *foundational affordances*: every respondent identified these as indispensably important to their rescue. Locatability and reachability were the two foundational affordances identified in the data analysis, yet along with their perceived necessity, drawing on these affordances had significant costs, which created a conundrum.

Locatability. Locatability proved to be a common affordance that all participants drew upon when using their mobile devices, but their use of this affordance varied and depended on battery life. Locatability was utilized as a means to (a) share exact location, (b) find other people's locations, and (c) organize during and after rescue. In these rescuee data, people did not explicitly mention privacy concerns that could be linked to sharing a location, but in several situations the interviewees commented that they had no choice. For example, rescuee Ann lived with her 80-year-old father in a multifamily apartment. She was disabled and had diabetes, and lived on under US$15,000 per year.
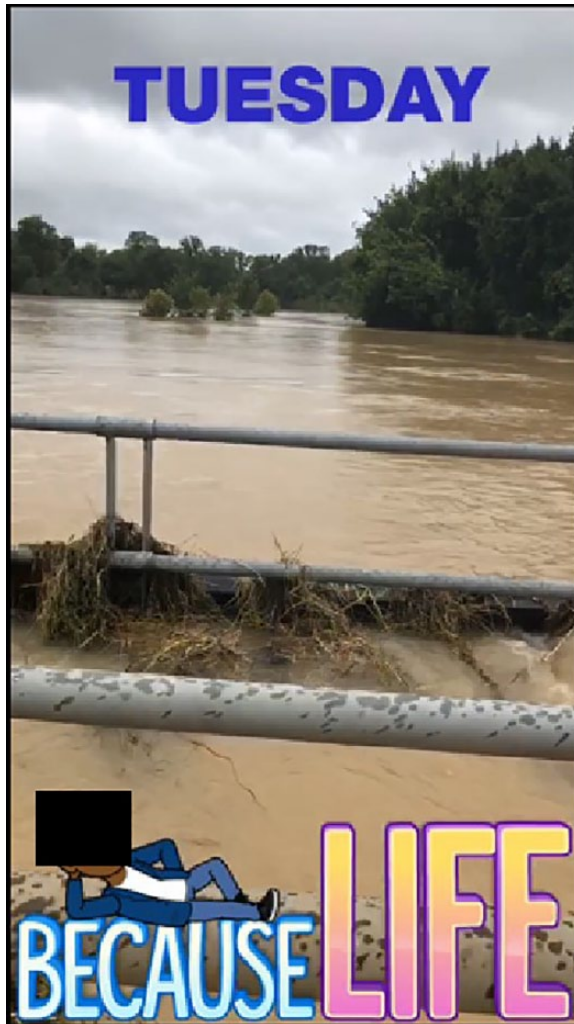
Figure 1. Snapchat image retrieved by Jon during his interview. This image was taken by Jon when he was walking in the contaminated water outside his apartment.

She described her use of locatability bluntly because she felt like she had limited options, "Well, I did call for a rescue on Facebook. We *had* to put my information on Facebook because we didn't have no working phone. We couldn't call. How in the world were they gonna find us?"

Another rescuee, Faith, an avid social media user, drew more broadly on the affordance of locatability to keep tabs on others affected by the hurricane and to help her predict if her home would be flooded again. She explained:

I was totally on Facebook. And people created Harvey rescue pages. I tried to see what was really happening and what we needed to do. You were able to contact people that were in other areas, [even when] you didn't know what was going on in your area. People were finding out things on Facebook.

Beyond physical locations. Rescuees also used their mobile and social media to share important details about their locations that went beyond a physical address. During the floods, often street signs were obscured by water, and it was hard to tell where roads were located. If homes had their addresses painted on the curb, they were meaningless in a sea of polluted water. Karen, a middle-aged rescuee from an upper to middle-class neighborhood described how the information she shared helped her get rescued, "They have the address. And they had a map. But they didn't know the roads were gone [covered with water], but they were still able to find our house. So yeah, I think that [sharing my location] was important."

Rescues were often multiphased and involved coordinating with different people who were using vehicles capable of handling the changing water conditions. Mick described this situation:

We actually arranged [our second rescue] because once we got to the gas station, we had nowhere to go. And I was like, "Okay, now what?" So we arranged it through Facebook: [for] someone to meet us at the gas station and take us somewhere. That was amazing.

This was a common practice in the communities we studied. Boats had to return quickly to rescue others, so they dropped rescuees in safe locations. The affordance of locatability was highly valued and used in myriad ways. Not only did people share their locations, they also monitored the locations of others and coordinated multilevel rescue efforts. But in sharing their locations, there were hints that privacy concerns created a conundrum: They felt they had limited options, and one interviewee, Tammy, received many comments on her post that were related to sharing her information publicly. For example, one commenter said, "Can we put out publicly on Facebook your address with a request that a boat come help? I have a friend who might be able to rescue you." Tammy responded that she had two dogs and asked if they could be rescued as well. The response was, "Absolutely! What's your address?" Tammy then commented back with her address, and subsequently other people asked if they could share her request.

Reachability. Another foundational affordance, reachability, was directly associated with the material features of mobile devices, and drawing upon it created a conundrum: being reachable was highly beneficial, but it also quickly drained mobile phone batteries. Furthermore, when rescuees were reachable, they could ask others to be their proxy if they lost access to their mobile devices. Being reachable by friends and family was important for many participants in this study. This included Faith, who explained:

We were keeping in contact. Actually, we were in a group message. I had a couple of people from Maryland, my mom, and my sister. And then I'm like, "Wow, the water's inside now. I'm going to get flooded again. Dammit." I remember at 3:00 a.m. getting a text from the group message, and a friend in Maryland [asked], "OK what's going on now? Are you having to be rescued? Get out!" She kept saying, "Get out!"

Jon, the young marketing manager, explained the fear he felt when he realized he was not reachable. Without his mobile phone, Jon had to rely on visual cues. He explained:

> Once [my] availability was gone and then my phone went dead, that's when I started freaking out myself because I didn't know what was going on in the outside world. The only thing I think I could see was my front balcony, which—oh my God—luckily faced the street. I was able to see the trucks and stuff coming by and I could also see how far the water was rising.

This comment, along with similar sentiments found in the data, suggests people view their mobile social networks as a literal lifeline. However, drawing upon the affordance of reachability during a disaster comes at a high price: the complete loss of having the device used for connection. When the battery is drained, people lose all ability to draw upon any affordances. They cannot connect, communicate, or call for help. Furthermore, the loss of smartphone power is often rather sudden in this type of a disaster, and our respondents commented that their use was much greater than in their normal life.

Sets of affordances that amplified rescue needs. Two affordances were identified that served to amplify rescuees calls for help: visibility and association. Whereas the affordance of visibility in an organizational context is often associated with impression management (Treem & Leonardi, 2012), that is not the underlying goal found in disaster rescues. These people needed to make their *situation* visible, and they found that by invoking affordances found in mobile social networks they amplified the visibility of their message and captured others' attention. To accomplish this goal, people often used multiple media that included images and videos in addition to text.

As Jon's prior example (found in Figure 1) illustrates, taking pictures during the storm was extremely important because he then used Snapchat to send geotagged pictures and videos to update his friends on the status of the flooding he was experiencing. Jon explains how he drew upon this set of amplification affordances:

> The ability to take pictures was so important, and I was able share them describing kind of what was happening in my own place. I just recorded everything. That was a huge thing because it allowed me to share what I was seeing.

This set of affordances went well beyond allowing individuals to document and share their experiences. Sharing vivid images captured their audience's attention in provocative ways. It was as if the shared images *boosted the rescue messages* and accomplished two things: persuasively calling others to act on their behalf, and evoking peer networks that in turn persuaded the potential rescuee to evacuate. The rescuee, Faith, explained compelling desires to help that people felt when they saw pictures on Facebook. She was scrolling through her social media feed, talking through her posts during her interview, when she said:

> It all happened in this area in [this city] and [everyone posted] a lot of pictures on Facebook. While you're on Facebook during the storm, you just keep scrolling and looking. You go to different people's pages. I [felt a need to] just keep scrolling. [Actually,] I was looking for my daughter's posts and I felt relieved when I saw she had posted pictures on her page.

Amplification of others' concerns. Drawing on amplification affordances amped up the messages people were sending by heightening their relational relevance. Not only did the images and videos capture a more complete experience, but they also made people feel closer and more compelled to act during rescues: the images were a form of evidence of the devastation. Harij, a middle-aged permanent U.S. resident from India, reiterated how important including a picture with a call for help actually was. He did not use Facebook, but his wife, Anika, who joined us for most of the interview, was the first person in their family to start posting pictures on Facebook. Harij explained their decision to evacuate:

> So it was Sunday morning. We were watching the rain. Streets were starting to get flooded, but not in the house yet. So my wife took a picture and put it on Facebook that [said], "Hey, the water is all the way to the front door, maybe another few feet away." And then suddenly our friends starting calling, "Hey, Harji, it's dangerous," and some people said, "Hey, the streets are flooded, don't evacuate." Some others friends said, "No, you should evacuate." But then there was one friend . . . he kind of pushed us.

Anika explained her reasoning for posting the pictures by saying, "It was like, this is our situation." Harij explained how the photo amplified their call for help:

> We were able to evacuate, so I think the credit goes to my wife for putting up the pictures. Then my friend seeing it. Then he's connecting to another friend. So that's an example of how connection [through social media and the phone] worked out. The picture made it successful, to me the picture made it successful.

Association as amplification. The second specific affordance grouped into the set of amplification affordances was association. Rescuees' associations with groups served to amplify their rescue messages; they were also tapping into their social capital reservoir, much like Ellison and Vitak (2015) found in their summary of studies. In all cases in these data, rescuees' Facebook, WeChat, and WhatsApp posts were shared within and by members of their affiliated groups, and that appeared to increase the urgency of their rescue requests. For example, we observed and took field notes in a Chinese Christian church in this community and learned they had a special WeChat group they created to coordinate the rescues and housing of their members. By examining the image data, our respondents provided us with what was shared through their larger community of Facebook and Nextdoor groups, through which we found clear evidence that members of these groups knew one another, often knew their neighborhoods, and this localized knowledge helped facilitate rescues. For example, Emily discussed her homeowners' association:

> Yeah. I've been in the community neighborhood over there, and I'm actually talking to Nextdoor as well, because they set up a map system where they could literally track [homeowners]. One of our homeowners' association members, a really militant woman who sat literally and tracked [using Nextdoor] who was out of their homes and who still needed to be rescued.

There were striking data throughout the images and text posts in these private social networking sites that revealed the power of these connections. Being a member of a

homeowners' association, religious organization, school group, or club, seemed to heighten awareness of these posts and the likelihood of them being forwarded, shared, or tagged.

In addition, some employers were actively involved in the rescue and recovery process, so this provided insight into how being an organizational member might function in terms of an association affordance. Sam worked in the oil industry, and he was also a member of a tight-knit Chinese church group that had an active WeChat rescue group during the disaster. Sam lived on the third floor of a condominium complex, and even as the water rose, he kept saying he was high enough to be safe. He explained how his employer,

> . . . pushed me, when the water first came in my home, the VP called me, "Hey, get out. Get out," and I said, "I'm fine." But after resisting for 3 days, I called my supervisor, "Okay, wow, the water is really coming up strong, and I mean the tide is really up. I will go." Then the senior VP sent me a text message, "Get out of there. Call 9-1-1." Right after that I saw the evacuation boat show up [from my church], I'm blessed.

The boat dropped him off on high ground near a Randalls grocery store. From there, Sam explained, "the HR people took us to the hotel, right away. They were already preserved; they counted the people who had been flooded, and they reserved the rooms. Once you're rescued they put you there [for 2 weeks and paid for the rooms]."

Discussion

This research allows us to develop a model of mobile social network dispersion in disaster rescues to illustrate how people use communication technologies in rescue decision-making. These findings contribute to mobile communication and social media research in two ways. Our analysis of these rescue decisions reveals two important roles that other people play: they help to socially construct risk as they encourage loved ones to get out of harm's way, and they serve as proxies to help compensate for material limitations. We also show that mobile social network affordances can be organized into two sets, and hierarchical relationships exist among them, as well as between material considerations and affordance sets.

People's decisions to ask for help—through official 9-1-1 channels, text messages, phone calls, face-to-face conversations, and from mobile social networks—are shaped by material concerns, as well as by the messages they hear and see from friends, family, neighbors, and to a lesser extent, official organizations. Portability of mobile devices enables rescuees to take their smartphones with them as they evacuate, but those same devices can succumb to a loss of power and failure due to weather. While current practices during emergencies are to contact officials through 9-1-1 systems, catastrophic disasters affecting entire communities appear to disrupt conventional processes. Furthermore, perceptions of who *should* be relying on 9-1-1 resources are much more of a personal decision driven by individuals' past experiences, understandings of what dire circumstances are, and embarrassment for not realizing the seriousness of the situation until a rescue is imperative. In this study, many of those messages were shaped by information garnered through mobile and social media, and it influenced people's key decisions such
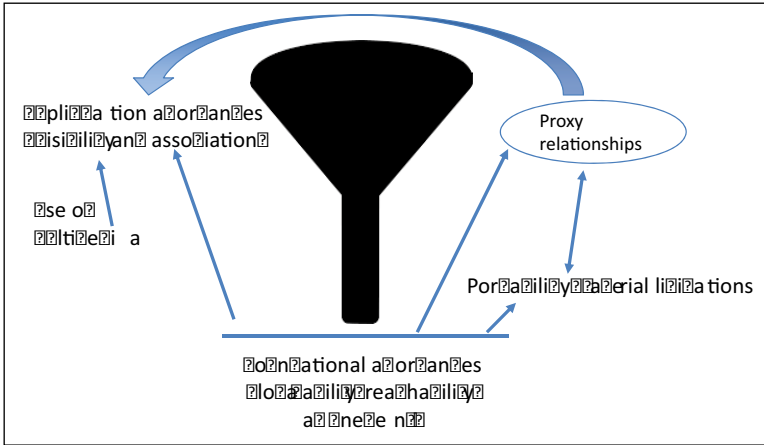
Figure 2. Model of mobile social network dispersion in rescue communication.

as when to evacuate, whom to ask for evacuation help, and when official rescue resources were available.

Elaborating relationships in our theoretical model

In Figure 2 we synthesize our findings and develop a model of mobile social network dispersion in disaster rescues. The model uses symbols deliberately, and the megaphone graphic depicts how calls for help are dispersed using amplification strategies. At the base of the model are the foundational affordances. These are affordances that are essential for a rescue to occur. In our study data, we identified two such affordances, locatability and reachability, but when considering the pivotal and often persuasive role that others played, a third affordance emerged that we call *attunement*. Our findings suggest that people draw upon the affordance of locatability in myriad ways such as sharing location, posting addresses, and describing landmarks when the water obscured physical address labels. This is akin to Frith's (2015) idea of locative media, often discussed as a material feature of a smartphone through which users share information about their surroundings.

The salience of this materiality was heightened when rescuees described how they drew upon the affordance of reachability. For tangible and emotional reasons, respondents wanted others to be able to reach them, and quite often their loved ones wanted continual updates. It is the interaction between the material limitations and reachability that helped us define this affordance as foundational.

The final foundational communicative affordance is what we call attunement. As rescuees invoked their mobile social networks, they bounced information off others. Until situations were dire, communicative attunement served to help people assess their own risk and make rescue decisions. In this way, rescue communication is a socially constructed process: being told to evacuate is not enough, it takes trusted others saying "get out."

On the right side of the model, we focus on materiality, and it also shows how materiality interacts with proxy relationships. The portability of smartphones was mentioned by every participant in our study, but not only did that provide them access to their lifeline, it also came with material limitations: battery drains. Many of our rescuees overcame these material limitations and further amplified their calls for help by using other people we labeled proxy relationships. These proxies posted messages on behalf of the people needing rescue, something very important when there was no power and smartphone battery life was drained. All the people in our dataset, except one (who evacuated fairly early), mentioned the role that other people played when they posted for them or shared their posts through their own networks. In this way, proxies, in addition to rescuees, can draw upon mobile social network affordances; they can be shared.

On the left side of the model, the dispersion process is elaborated, with the highest level being amplification affordances. There are two of these affordances in our data: visibility and association. Visibility is most often found when people post a call for help on social media, and when they used multiple media like photos and videos, this further amplified the visibility of their messages. Because most smartphones have photo- and video-capturing capabilities, taking pictures and videos through mobile devices is now considered a commonplace practice (Lenhart, Ling, Campbell, & Purcell, 2010; Murthy, 2018). Research has explained that individuals can use images captured on mobile devices to express emotions and moods (Hjorth, 2007; Koskinen, 2007). Association is the other part of the set of amplification affordances found in our data. When people tap into their existing networks, those associations appear to spur feelings of community and identity (Ellison & Vitak, 2015), and they increase the likelihood of rescue messages being heard.

This model begins to explain how mobile social networks function in rescues. It illustrates conundrums, the role of materiality, and the foundational role trusted others play as people asses their own risk and make rescue decisions. We also illustrate the importance of context in our model, as well as naming affordance sets that can be expanded in the future. It is very likely that, in a different disaster, foundational affordances might not center on locatability, reachability, and attunement; but having a framework to understand human behavior around mobile social networks is an important theoretical step.

Limitations and future directions

This study is not without its limitations. The number of participants was relatively small; although, as suggested by prior work on vulnerable samples, if the depth of conversation about a sensitive experience is sufficient, a smaller sample can still be highly informative (Moore & Miller, 1999). Considering that all our participants shared their personal rescue stories and showed us images and videos to further elaborate their views, we believe that our findings and analysis reflect shared perspectives. Note that while we did have race/ethnicity and income variability, we had no Latino/a participants, and in this part of the US, they constitute approximately 48% of the population. This should be considered when evaluating the generalizability of our findings, but we developed our model using descriptive terms that invite future research in different contexts. Another limitation concerns the socioeconomic status needed for individuals to afford smartphones and thus be capable of using social media during a disaster (Xiao, Huang, & Wu, 2015). Our study

did not include many individuals at the extreme poverty line, but the one person in our study with an annual income under US$15,000 still owned a smartphone, but she was careful when choosing Internet and payment plans. Digital disparities are an important area of study, especially in low-income areas that are often disproportionately affected by disasters.

Our empirical extension and development of a theoretical model substantiates claims made by Humphreys et al. (2018), while illustrating the importance of context in technology affordance research. Furthermore, these findings are relevant to local and governmental agencies, including the U.S. Federal Emergency Management Agency (FEMA); city, county, and state emergency responders; and volunteer rescuers who want to better understand the mobile and social media practices of people who really need to be rescued during a disaster.

It is also possible that different social media platforms have different affordances, and that might explain why none of our respondents mentioned using Twitter to get rescued. We asked open questions concerning the social media platforms and communication channels each respondent used (see Table 1 for a listing), and Twitter never came up. Since this study is part of a larger study that included some official emergency responders, they did mention Twitter. We are unsure why Twitter was virtually absent from our rescuees' data, but it is worth further exploration.

Future American disaster victims will quite likely continue the trend of turning to social media rather than, or in addition to, 9-1-1 even if 9-1-1 expands beyond phone-based reporting services. By understanding Hurricane Harvey rescuees' mobile social networking practices, and the role trusted others played in both helping them realize they were at risk and then serving as proxies to request help for them, we will be better prepared to save lives.

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